Levee Assessment

Submitted to:
California State Coastal Conservancy
U.S. Fish & Wildlife Service
California Department of Fish and Game

Prepared by:
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LEVEE ASSESSMENT
South Bay Salt Pond Restoration Project
Bay Area, California

1.0 EXECUTIVE SUMMARY

This report summarizes Geomatrix's assessment of existing levees for the South Bay Salt Pond Restoration Project. The focus of the assessment is program level evaluation of geologic and geotechnical factors contributing to:

- the conditions of outboard pond levees as described during the 1984 reconnaissance surveys performed by the Army Corp of Engineers in support of the reports entitled "Office Report, San Francisco Bay Shoreline Study, Southern Alameda and Santa Clara Counties Interim", dated October 1988, and "Office Report, San Francisco Bay Shoreline Study, San Mateo and Northern Alameda Counties Interim", dated September 1989.
- the observed and documented changes in conditions of outboard pond levees since the 1984 reconnaissance surveys performed by the Army Corp of Engineers, and
- the planning of proposed new inboard flood control levees.

The assessment includes development of a baseline levee model which compiles readily available existing data from multiple sources including multiple geotechnical reports, maintenance records, aerial photos, and field reconnaissance surveys. Significant reports referenced in the baseline levee model include:

- "Baylands Salt Water Flood Control Planning Study", prepared by Tudor Engineering Company, dated January, 1973.
- "Urban Levee Flood Management Requirements South Bay Salt Pond Restoration Project", prepared by Moffatt & Nichol Engineers, dated January, 2005.
- "Office Report, San Francisco Bay Shoreline Study, Southern Alameda and Santa Clara Counties Interim", prepared by the U.S. Army Corps of Engineers, dated October 1988.
- "Office Report, San Francisco Bay Shoreline Study, San Mateo and Northern Alameda Counties Interim", prepared by the U.S. Army Corps of Engineers, dated September 1989.

Two years of aerial photographs were reviewed (1988/1989, 1999). The 1999 interval was selected based on photo completeness and quality, to represent relatively recent conditions. The 1988/1989 interval was selected based on photo completeness and quality, to represent post heavy precipitation and flooding conditions experienced during the winter of 1986-87.

Limited field reconnaissance was performed by Geomatrix personnel in September 2006 to observe current conditions and verify, by observation and simple field measurement, existing features of select SBSP levees identified during the review and compilation of previous reports, maintenance records, and aerial photo review.

The baseline levee model consists of a geospatial database that describes the subsurface, levee and maintenance conditions across the study area. The baseline levee model is used to describe and visualize levee conditions in support the levee assessment.

For existing outboard pond levees, the levee assessment discusses the following general mechanisms of observed and documented levee degradation:

- subsidence,
- stability, and
- erosion.

The approximate quantity and size of past levee grading and erosion maintenance activities are summarized for each pond complex. Approximate return rates for past levee grading and erosion maintenance activities are presented. These return rates can be extrapolated to estimate future levee maintenance needs.

For proposed inboard flood control levees, significant quantities of new fill are anticipated to substantially raise levee crest elevations for increased flood protection. The levee assessment discusses the following additional mechanisms of levee degradation and considerations anticipated from the new fill placement planned:

- subsidence, and
- stability.

The locations and alignments of proposed inboard flood control levees currently being considered by the SBSP Restoration Project team are similar to those previously evaluated by Moffat & Nichol, 2005. Relevant findings from the Moffat & Nichol, 2005 report are incorporated into the assessment of proposed inboard flood control levees.

2.0 INTRODUCTION

The overarching goal of the SBSP Restoration project is the restoration and enhancement of wetlands in the South San Francisco Bay while providing for flood management and wildlife-oriented public access and recreation. In achieving this goal, the project is committed to maintaining or improving existing levels of flood protection in the South Bay area. The condition and projected performance of existing and proposed new levees are therefore critical considerations. Understanding the geologic and geotechnical framework of the SBSP Restoration project area, and the geologic and geotechnical conditions contributing to the current performance of the exiting levees, is integral to the success of assessing flood control, project planning, and future levee design.

2.1 BACKGROUND

The SBSP Restoration project area includes the Ravenswood and Eden Landing pond complexes shown on Figure 1. With authorization of the concurrent Shoreline Study project, the SBSP Restoration project also includes the Alviso pond complex shown in Figure 1.

The SBSP restoration alternatives are described in the SBSP Restoration Project Final Alternatives Report (PWA and others, 2006). The report identifies three restoration alternatives: 1) No Action; 2) the Tidal Habitat Emphasis Alternative; and 3) the Managed Pond Emphasis Alternative; plus the Adaptive Management process for implementing the restoration.

The evaluations and assessments performed for the SBSP Restoration project are generally at a program, broad planning scale, level of detail.

2.2 PURPOSE AND SCOPE OF WORK

The purpose of this study was to develop a geotechnical/geological assessment of existing levees within the SBSP Restoration project area. The assessment includes existing outboard pond levees within the SBSP Restoration project area, as well as proposed new inboard flood control levees.

To achieve this goal, Geomatrix first developed a baseline levee model to characterize the conditions of existing levees within the project area. The baseline levee model includes various readily available data sets (aerial photos, subsurface explorations, reconnaissance surveys, maintenance records, etc.) gathered from numerous sources, compiled into a single GIS

database. No new field geotechnical investigations were performed for this study. The existing data gathered, spans decades and is used to present snapshot portrayals of various levee conditions on select dates, as well as to illustrate general levee progression, or regression, over time. The baseline levee model captures geotechnical information valuable for future project design and planning efforts.

The baseline levee model was then used to describe and visualize levee conditions to support the levee assessment. The information compiled in the baseline levee model was organized to illustrate changes in conditions of the project levees, and maintenance requirements, over the past 20 years. Levee erosion, and subsidence, as well as Cargill maintenance operations from 1995 through 2005 were evaluated and are discussed. Specific seismic deformation and stability evaluations were beyond the scope of this assessment.

The results of this assessment will be used in subsequent SBSP Restoration project tasks and subtasks to estimate program level project impacts related to geology and soils, as well as to estimate the scope and cost of potential levee improvements as they pertain to the various restoration alternatives under consideration.

This programmatic-level geologic and geotechnical assessment was prepared in accordance with the Professional Services Consulting Agreement between PWA Consultant, Inc. (PWA) and Geomatrix, dated June 2006. This agreement contains a detailed description, by task, of the scope of work described above.

2.3 PROJECT PERSONNEL

The work described in this report was coordinated with the following individuals:

- Michele Orr, Project Manager, PWA
- Steve Ritchie, Program Manager

Key Geomatrix personnel who participated in the study included:

- Meghan Koch – Staff Engineer
- Kevin Burlingham – Staff Engineer
- Ron Rubin – Staff Geologist
- Robert Wright, Ph.D., CEG – Senior Geologist

- Chris Coutu, P.E. – Senior Engineer
- Timothy I. Mote, Ph.D., CEG, GISP - Project Manager/Senior Geologist
- Faiz Makdisi, Ph.D., P.E. – Principal-in-Charge

2.4 ORGANIZATION OF REPORT

A brief project description and background information was given in Sections 2.0 and 2.1. A review of the existing geologic/geotechnical data prepared by other consultants in the SBSP Restoration project area is described in Section 3.1. The review of aerial photographs and historic topographic maps and the field reconnaissance conducted in the SBSP Restoration project area are described in Sections 3.2 and 3.3. Section 4.0 describes the baseline levee model developed to assist in Levee Assessment. Section 5.0 discusses Geotechnical Considerations and Levee Assessment. References used in this study are presented in Section 7.0.

This report includes four appendixes that correspond to the Baseline Levee Model. Appendix A includes existing subsurface data that was compiled and reviewed as part of our geotechnical/geologic evaluation and characterization. Appendix B is a summary of the USACE 1984 Levee Reconnaissance Survey. Appendix C is a summary of the Moffat and Nichol Engineers, 2005, Levee Reconnaissance Survey. Appendix D is a summary of Cargill 1995 to 2005 Levee Maintenance Reports.

3.0 DATA COMPILATION AND REVIEW

Levee conditions and subsurface data for the South Bay and the SBSP Restoration Project area were evaluated using existing published data. Sources of data included the following:

3.1 EXISTING REPORTS

Geomatrix reviewed existing geologic/geotechnical data of several private and public agencies. Subsurface information that was judged to be pertinent to the characterization of levee and subsurface conditions within and proximal to the SBSP Restoration project area was collected and summarized.

3.1.1 Levee Assessment Reports

Files from four major reports prepared by Tudor Engineering company (Tudor, 1973), the U.S. Army Corps of Engineers, San Francisco District (Corps, 1988 and 1989), and Moffatt & Nichol Engineers (Moffatt & Nichol, 2005).

The Tudor (1973) report describes a compilation of known existing geotechnical exploration data collected within the Baylands (southern Alviso) area through 1972. Contours of thickness of Bay Mud were developed from the existing exploration data.

The Corps (1988) report describes a levee and shoreline condition survey that was performed between March and May 1984. The information collected for each levee segment included: the width and condition of the levee crest; the lengths, angles, and condition of the embankment slopes; the type and condition of slope protection; the embankment soil type; and other pertinent information including evidence of slumping, cracking, erosion, or seepage. This data is summarized in Appendix B.

In 2005, Moffatt & Nichol prepared a report for the California State Coastal Conservancy to summarize evaluations performed for then current configurations of new inboard flood control levees throughout the SBSP Restoration Project area, which could function as perimeter (Bayfront) levees after implementation of the proposed restoration project. The alignments of the new inboard flood control levees, evaluated by Moffat & Nichol, are similar to those currently being considered by the SBSP Restoration Project team. Evaluations performed by Moffatt & Nichol, 2005 are incorporated into the discussion of proposed inboard flood control levees (Section 5.3). Limited field reconnaissance data gathered by Moffat & Nichol in support of their 2005 report are summarized in Appendix C.

3.1.2 Subsurface Borings and Bay Mud Thickness

587 boring logs compiled within and proximal to the SBSP Project study area (Plate 1) were interpreted by a geologist to identify and summarize key geologic units essential to engineering evaluation including thickness and depth of stratigraphic units (i.e. fill, alluvium, Bay Mud, etc.), thickness of liquefiable layers, and depth to bedrock. The geologic data was integrated into a geotechnical database (Appendix A). Where borehole (or well) collar coordinates was not provided, locations were digitized from historic maps in order to link to the GIS. Borehole header information (data source, driller, drill type, date, etc.) was included when available.

We suspect that more geotechnical data exists. We have made many attempts to contact private and public land owners, utility operators, agencies, etc. The data presented in Plate 1 and Appendix A represents all data that we've been able to access and specifically locate.

A map of bedrock outcrops was extracted from the general distribution of geologic materials in the San Francisco Bay Region (Wentworth, 1997).

Liquefaction susceptibility (Knudsen and others, 2006) was based on sub-surface conditions including soil type, soil thickness and depth to groundwater.

3.1.3 Cargill Maintenance Reports

A summary of Cargill maintenance reports was compiled for the years 1995-2005. This data is summarized in Appendix D. The total number and amount of repairs completed for each pond complex is presented in Table 1 and the summations of events and amount of material used for each pond are included in Table 2.

The reports obtained summarized maintenance activities requiring permits from the San Francisco District Corps of Engineers and the San Francisco Bay Conservation and Development Commission such as: grading of the levees, discing of material, maintaining rip rap, and construction of new levees. The data typically included a general description, approximate duration, and general amount of materials required for each activity.

Grading activities included: routine grading of the levee top to provide vehicle access, building up low spots, and placing dirt fill to raise the levees. These activities were carried out using both dredging and land-based equipment.

Discing activities consisted of discing dredged material placed on the top of the levees.

Erosion related activities included widening eroded areas, and placing/replacing riprap to sustain the effectiveness of slope protection in those areas.

Levee construction included the construction of division levees inside the existing ponds. This was completed to improve the overall system of ponds.

The maintenance records were edited and simplified to summarize activities relevant to this assessment. Operational activities (e.g. gate maintenance) were not considered relevant to this study and therefore were not included.

There were some limitations in the maintenance data. The descriptions of the activities often did not fully explain the type and quantity of work performed. Sometimes the descriptions were too general to differentiate between maintenance activities. Quantities of materials (riprap, fill, etc) used during maintenance were inconsistently reported, sometimes quantified as footage, sometimes as volumes, sometimes not quantified. Thus the values for the amount of material placed should not be used in comparisons of the ponds. Other problems with the data include the conflict between discing and grading. In the description for discing, the reports state that dredged material was placed on top of the levee, but no entry for that placement of material could be correlated with the discing entry. Another example of the limitations of the data include an entry on the placing of pilings and sheet piles that does not state whether they are being used temporarily to assist in the installation of other equipment or if they are permanent.

We have edited the data such that these limitations of the data are minimized so that useful information can still be taken from the maintenance report data.

3.2 REVIEW OF AERIAL PHOTOGRAPHS

Two sets of stereo-paired, black and white aerial photographs were examined with a stereoscope to assist in the evaluation and identification of levee conditions, and other potential geologic/geotechnical hazards within the project area. The sets reviewed include:

Year	Scale
1988/1989	1:12,000
1999	1:12,000

The photographs document conditions along the levees at the time the photographs were taken. Comparison of landform features observed in the photographs and other data sources (i.e.

USACE 1988), allow for interpretations of changes in conditions over time (i.e., between 1984 to 1999). Conditions/features identified on the photographs include general levee condition, protection type/condition and evidence of distress. Examples of distress include erosion, undercutting/gullying, cracking, seepage, breaching, over-topping, and slumping.

The observed conditions/features were noted on maps of the study area and integrated into the baseline levee model to support engineering evaluations.

3.3 FIELD RECONNAISSANCE

Geomatrix personnel performed a field reconnaissance of the SBSP Restoration Project area on September 20, 21, and 22, 2006. Geomatrix's field reconnaissance consisted of observing current conditions and verifying, by observation and simple field measurements, existing features of select SBSP levees identified during the review and compilation of previous reports, maintenance records, and aerial photograph review.

The majority of the levees surrounding ponds within the Alviso, Eden Landing, and Ravenswood complexes were accessed and observed during Geomatrix's reconnaissance. Entry onto the Don Edwards San Francisco Bay Wildlife Refuge (Alviso and Ravenswood Pond Complexes) were coordinated with representatives of the US Fish and Wildlife Service. Entry onto the Eden Landing Pond Complex was coordinated with representatives of California Department of Fish and Game. Many of the levees were accessed by Geomatrix personnel traveling in vehicles. Several of the levees were accessed by Geomatrix personnel traveling on foot.

Conditions observed by Geomatrix field personnel during the field reconnaissance were digitized into the baseline levee model, and are summarized in Table 3. Levees were generally referenced by their position (north, south, east, west) relative to adjacent ponds. Digital photographs were taken along the levees to document typical and significant levee conditions/features relevant to the assessment. Select photographs are presented in the attached Photographs Section of this report to exemplify levee conditions.

Conditions/features identified during Geomatrix's field reconnaissance were categorized in a manner that was generally consistent with previous reconnaissance efforts by the USACE (1989) and Moffatt & Nichol Engineers (2005). Features observed and summarized include general levee condition, evidence of distress, and slope protection type/condition. Levee conditions of interest include crest condition, slope condition, toe condition, visually apparent

signs of distress, slope protection type, and slope protection condition. Signs of distress observed by Geomatrix included erosion, undercutting/gullying, cracking, seepage, breaching, over-topping, and slumping. An examples of cracking distress is presented as photograph 6 in the attached Photos Section of this report. An example of poorly repaired breaching, and over-topping distress is presented as photograph 7 in the attached Photos Section of this report. An example of undercutting distress is presented as photograph 8 in the attached Photos Section of this report. An examples of gullying distress is presented as photograph 9 in the attached Photos Section of this report. Example of erosion distress are presented as photographs 8, 9, and 10 in the attached Photos Section of this report.

4.0 BASELINE LEVEE MODEL

A baseline levee model was developed to document the conditions and performance of the levees over the last 20 years. The model describes subsurface conditions, levee conditions, and maintenance activities. Maps generated from the baseline levee model are used to support evaluation of geotechnical considerations and evaluate the specific pond complexes within the context of the three project alternatives. The implementation of the baseline levee model in the execution of the levee assessment is discussed in the geotechnical considerations sections. Description of the subsurface conditions, levee conditions, and maintenance activities components of the baseline levee model are presented below.

4.1 SUBSURFACE CONDITIONS

The occurrence, thickness, consistency, and engineering properties of Bay Mud, and loose saturated granular (potentially liquefiable) soils are expected to heavily influence the future performance of existing outboard pond levees, as well as the design of new or improved inboard flood control levees. The subsurface conditions component of the baseline levee model consists of a Bay Mud thickness map (isopach) from compiled geotechnical exploration data, and a liquefaction potential map.

The Bay Mud thickness map is derived from observed contacts from historic geotechnical exploration data. Tudor (1973) presents a map for Bay Mud thickness contour map for the South Bay compiled from several hundred borings. This contour map was digitized and updated with data from borings drilled subsequent to the Tudor report. Surface mapping of bedrock outcroppings by Wentworth (1997) helped define the limits where the Bay Mud pinches out.

Liquefaction susceptibility (Knudsen and others, 2006) is based on subsurface conditions including soil type, soil thickness and depth to groundwater. This is a generalized map developed for the nine county San Francisco Bay Area. To support future design and detailed assessments the boring data, which includes thicknesses of liquefiable units, will be used.

Figure 2 summarizes subsurface conditions in terms of liquefaction potential and Bay Mud thickness for the project area.

4.2 LEVEE CONDITIONS

The levee conditions component of the baseline levee model characterizes the levee alignment, levee protection, and catalogs evidence of distress. The sources of this data are the USACE, 1988, 1989 and Moffatt & Nichol, 2005 reports integrated with the aerial photograph review and field reconnaissance of this study (Geomatrix 2006).

Observations of levee alignment, levee protection, and evidence of distress are compiled in a database georeferenced to levee stretches. The database is a subset of key fields from the USCAE, 1988, survey methodology where the alignment, distress, and protection are parameterized in specific database fields.

Levee condition parameters include (database fields are shown in ***bold italics*** font):

Complex		Alviso, Eden Landing, Ravenswood
Pond ID		Unique identifier for Ponds
Levee Orientation		The orientation of the levee relative to the pond
Crest, Slope, and Toe Condition		Good, Fair, Poor
Evidence of Distress		
Cracking	=	CR
Seepage	=	SE
Overtopping	=	OV
Slumping	=	SL
Breach	=	BR
Undercutting/Gullying	=	UN
Erosion	=	ER
Erosion Intensity		Severe, Intense, Moderate, Slight
Protection Condition		Good, Fair, Poor
Protection Type		Vegetation, riprap, broken concrete, other.
Data Source		USACE (1988), M&N (2005), GMX (2006)

The descriptive values for the levee and protection condition fields are qualitative in nature. The numerous reports and professional assessments of the levees over the years proved difficult to enforce consistency. For this study we consider "Good" to imply that the "Levee is performing", "Fair" implies that the "Levee is performing, but there are slight signs of distress", and "Poor" implies that "Levee shows significant signs of distress and/or failure".

The levee conditions component of the baseline levee model is presented in Table 3.

A series of maps for the pond complexes were generated from the baseline levee model to describe the levee conditions where data was available. The maps present the general levee condition, type/condition of levee protection, and evidence of distress, by graphically presenting a number of appropriate model fields. The parameters presented in these maps are a subset of fields describing the data which summarizes the critical features of the levees. The complete baseline levee model (Table 3) contains more detail than presented on the figures of this draft report. Other combinations of data, including comparisons, can be presented using the baseline levee model. Baseline data, not specifically presented in the figures of this draft report may also assist in future project specific detailed geotechnical evaluations.

Figures 3a, 3e, and 3r are a series of maps for each respective pond complex (Alviso (a), Eden Landing (e), Ravenswood (r)) showing summarized levee alignment conditions for the crest, slope and toe. These figures include data compiled from multiple sources. Where overlapping data exists, that from the most recent source is presented. Levee conditions in Figures 3a, 3e, and 3r are labeled and color coded good (blue), fair (yellow) and poor (red).

Figures 4a, 4e, and 4r are a series of maps for each respective pond complex showing summarized levee protection type and conditions. These figures include data compiled from multiple sources. Where overlapping data exists, that from the most recent source is presented. Slope protection types (broken concrete, riprap, vegetation, other) for each levee are indicated on Figures 4a, 4e, and 4r by symbols. Examples of the various slope protection types are illustrated in photographs 1 through 5 in the Photograph Section of this report. Slope protection conditions in Figures 4a, 4e, and 4r are color coded: good (blue), fair (yellow), and poor (red).

Figures 5a, 5e, and 5r are a series of maps for each respective pond complex summarizing observed levee distresses. These figures include data compiled from multiple sources. Where overlapping data exists, that from the most recent source is presented. The types of observed levee distress are labeled on Figures 5a, 5e, and 5r. Examples of the various levee distress

types observed by Geomatrix during recent reconnaissance are illustrated in photographs 6 through 11 in the Photograph section of this report. Erosion intensity presented on Figures 5a, 5e, and 5r is color coded: severe (magenta), intense (red), moderate (brown), and slight (green).

4.3 MAINTENANCE

The maintenance component of the baseline levee model characterizes the levee maintenance over the last decade in terms of type of maintenance, repair and volume (when reported). Refer to section 3.1.3 for details on the compilation of the maintenance records (Table 1, Table 2, and Appendix D).

Figures 6a, 6e, and 6r are a series of maps for each respective pond complex showing maintenance efforts to repair erosion and subsidence for the time period 1995 to 2005. Since the volume of material used in the repairs was not consistently reported, these figures present both the number of repair events and the volume. The type of repair has been broken into two components: grading events to repair subsidence and riprap placement to address erosion. Both of these events are shown as a bar chart for each pond. A summary table also is included on each figure.

The frequency and type of repair are further discussed in the Section 5.0.

5.0 LEVEE ASSESSMENT / GEOTECHNICAL CONSIDERATIONS

5.1 GENERAL

The major geotechnical issues for levees within the SBSP Restoration project are:

- Relatively low strength and high compressibility of Bay Mud that exists within and below most of the existing levees;
- Potential liquefaction, and related hazards (lateral spreading), of loose saturated granular soils within and below many of the existing levees.

Almost all of the levees within the SBSP Restoration Project area are underlain by very soft, highly compressible, unconsolidated Bay Mud, and moderate to high (and in some locations very high) liquefiable susceptibility granular deposits. The specific locations thicknesses, and characteristics of these weak deposits should be considered while evaluating the lifespan and performance of existing outboard pond levees as well as while evaluating and designing proposed new inboard flood control levees. Contours of thickness of Bay Mud in the SBSP Restoration Project area are presented in Figure 2. Liquefaction susceptibility for the SBSP Restoration Project area (Knudsen and others, 2006) based on soil type, soil thickness and depth to groundwater is also presented in Figure 2.

The existing outboard pond levees were primarily constructed by excavating materials from within the ponds with the use of a dragline or clamshell and casting the excavated material to the side to form the levees. Periodically the levees were raised and widened using the same approach. Most of the salt pond levees consist predominantly of “cast-up” Bay Mud (Moffatt & Nichol, 2005).

Existing outboard pond levees within the SBSP Restoration Project area have been subject to the following mechanisms of levee degradation:

- subsidence resulting from ongoing consolidation of Bay Mud within recent pond levee fills;
- subsidence resulting from ongoing consolidation of Bay Mud beneath recent pond levee fills;
- subsidence resulting from ongoing consolidation of Bay Mud from regional groundwater depletion;

- subsidence resulting from liquefaction of loose saturated granular deposits during an earthquake;
- subsidence from consolidation of deeper Santa Clara Valley formation from regional groundwater depletion;
- slope failure resulting from liquefaction of loose saturated granular deposits during an earthquake;
- erosion.

Levee subsidence and erosion are expected to continue into the future. The rate and degree of existing pond levee degradation has in the past, and can in the future, be controlled with periodic levee maintenance. From Cargill maintenance records, we can quantify select maintenance activities performed between 1995 and 2005. These maintenance data are reasonably complete and allow for the most direct interpretation of levee maintenance required over a specified timeframe. This data can then be extrapolated as a means of estimating future maintenance needs for the SBSP Restoration project.

Proposed inboard flood control levees within the SBSP Restoration Project area will be designed for a certain lifespan and will account for the mechanisms of levee degradation discussed above. Proposed inboard flood levees are however expected to be subject to the following additional mechanisms of degradation which should also be considered during evaluation and design:

- subsidence resulting from additional consolidation of Bay Mud under the weight of new flood levee fills;
- slope failure resulting from overstressing (adding significant thicknesses of new fill) existing weak levee materials and underlying foundations;

More specific discussions of subsidence, stability, and erosion for each of the pond complexes within the SBSP Restoration Project area are presented in Sections 5.2 and 5.3, below.

5.2 EXISTING OUTBOARD POND LEVEES

5.2.1 Subsidence

Ongoing subsidence of the outboard pond levees can be attributed to: consolidation of Bay Mud within recent pond levee fills; consolidation of Bay Mud beneath recent pond levee fills; consolidation of Bay Mud from regional groundwater depletion; subsidence resulting from

liquefaction of loose saturated granular deposits during an earthquake; and subsidence from consolidation of deeper Santa Clara Valley Formation from regional groundwater depletion.

5.2.1.1 Subsidence From Consolidation of Bay Mud Within And Below Recent Pond Levee Fills

The main component of levee subsidence in the SBSP Restoration Project area is consolidation of Bay Mud within and below recent pond levee fills. Consolidation of Bay Mud occurs over time. Typically with soft clays like Bay Mud, a large portion of settlement occurs over a period of weeks or months, with the remainder occurring over a period of years, sometimes decades. The thickness of the Bay Mud layer strongly affects the time of consolidation. Thin layers consolidate more rapidly than thicker layers.

The degree and rate of subsidence caused by consolidation of Bay Mud within and below recent pond levee fills varies depending on:

- the weight and density of recently added fill,
- the thickness and engineering characteristics of underlying Bay Mud, and
- the time since recent fill placement.

Because of these variables, and limited record keeping during pond levee construction, the degree and rate of past subsidence caused by consolidation of Bay Mud within and below recent pond levee fills is not well defined. From the Cargill maintenance records, we can infer a generalized rate and degree of levee subsidence between 1995 and 2005 for each pond complex as indicated in the table below.

Cargill Maintenance Records 1995 - 2005			
	Ravenswood	Eden Landing	Alviso
Number of ponds	7	23	29
Total number of grading events per pond complex	103	283	397
Total quantity of new fill placed per pond complex (CY/LF)	1,780 / 116,723	5,730 / 139,165	3,780 / 413,179
Average number of grading events per pond	15	12	14
Average quantity of new fill placed per pond (CY/LF)	254 / 16,675	249 / 6,051	130 / 14,248
Estimated average subsidence per pond (inches/year)	1.8	0.6	1.1
Maximum number of grading events for individual pond (pond ID)	25 (R1)	31 (B1C)	26 (A15)
Maximum quantity of new fill placed for individual pond (CY/LF) (pond ID)	3,970(R2)/33,245(R1)	2,100(B1)/28,400(B2)	1,020(A15)/79,700(A10)

Notes:

1. Values in the table correspond to maintenance activities described in Cargill records as "grading". In some cases, quantity of fill placed is reported as volume (CY). In other cases, quantity of fill placed is reported as distance (LF). Not enough information is provided to convert LF to CY or to convert CY to LF. In some cases, a grading event is described, but no corresponding fill quantity is provided.
2. CY = cubic yards
3. LF = linear feet
4. Estimated average subsidence is very rough, and assumes:
    - Average crest width 15 feet,
    - New fill spread out over entire perimeter of pond,
    - Average pond perimeter at Ravenswood ~ 11,200 feet,
    - Average pond perimeter at Eden Landing ~ 13,400 feet,
    - Average pond perimeter at Alviso ~ 16,500 feet.

Though appropriate for programmatic-level evaluations, the quantities presented in the Table above should be considered approximate. Limitations of the Cargill data are discussed in Section 3.1.3.

The degree and rate of future subsidence caused by consolidation of Bay Mud within and below recent pond levee fills will likewise vary. From the Cargill maintenance records, we can develop generalized return rates for levee subsidence maintenance activities between 1995 and 2005 for each pond complex as indicated in the table below.

Cargill Maintenance Records 1995 - 2005			
	Ravenswood	Eden Landing	Alviso
Number of ponds	7	23	29
Total number of grading events per pond complex	103	283	397
Total return rate (years per event) of pond complex levee subsidence maintenance	0.10	0.04	0.03
Average number of grading events per pond	15	12	14
Average return rate (years per event) of pond levee subsidence maintenance (events per year)	0.7	0.8	0.7
Maximum number of grading events for individual pond (pond ID)	25 (R1)	31 (B1C)	26 (A15)
Minimum return rate (years per event) of levee subsidence maintenance for individual pond (pond ID)	0.4 (R1)	0.3 (B1C)	0.4 (A15)

Notes:

1. Values in the table correspond to maintenance activities described in Cargill records as "grading". In some cases, quantity of fill placed is reported as volume (CY). In other cases, quantity of fill placed is reported as distance (LF). Not enough information is provided to convert LF to CY or to convert CY to LF. In some cases, a grading event is described, but no corresponding fill quantity is provided.
2. CY = cubic yards
3. LF = linear feet

These return rates can be extrapolated to estimate future subsidence and/or maintenance requirements.

Though appropriate for programmatic-level evaluations, the quantities presented in the Table above should be considered approximate. Limitations of the Cargill data are discussed in Section 3.1.3. In assessing need for future levee maintenance, it is important to point out that the Cargill data spans only a 10 year period.

Cargill grading maintenance events per pond complex between 1995 and 2005 are also summarized in Table 1 and illustrated on Figures 6r, 6e, and 6r. Cargill grading maintenance events per pond between 1995 and 2005 are summarized in Table 2 and illustrated on Figures 6r, 6e, and 6r. Individual Cargill maintenance events between 1995 and 2005 are summarized in Appendix D.

Generally, the thickness and consistency of the Bay Mud is expected to vary gradually within the pond complexes and along existing levees within the pond complexes. Future levee subsidence from consolidation of Bay Mud is therefore also expected to vary gradually across existing levees within the pond complexes. The amount of future consolidation may cause portions of certain existing outboard pond levees to settle to, or below, minimum elevations required to prevent overtopping.

5.2.1.2 Subsidence From Consolidation of Bay Mud From Regional Groundwater Depletion

Lowering the groundwater elevation in areas that contain significant thicknesses of Bay Mud can cause consolidation of Bay Mud and ground subsidence. As much as 13 feet of surface settlement occurred in Santa Clara and San Mateo counties between about 1912 and 1969. This settlement is mainly attributed to regional groundwater depletion. Lowered groundwater elevations through this period increased effective stresses within local Bay Mud deposits, which caused consolidation and ground subsidence. Since 1969, the implementation of groundwater replenishment programs has slowed or stopped the consolidation and ground subsidence (USACE, 1989).

5.2.1.3 Subsidence From Liquefaction Of Loose Saturated Granular Deposits During An Earthquake

Saturated loose granular soils exist within, and below, sediments of the San Francisco Bay throughout the SBSP Restoration Project area. These soils are potentially liquefiable. During and immediately after ground shaking from a moderate to strong earthquake, saturated loose

granular soils may lose strength, and may experience relatively rapid volumetric change. The expression of liquefaction and the corresponding volumetric change is often ground subsidence.

The severity of the liquefaction hazard depends on:

- density of the saturated granular soils,
- depth and thickness of potentially liquefiable layers,
- magnitude and duration of the ground shaking, and
- distance to the nearby free face or ground slope.

Generally, looser deposits have the potential to densify more as a result of ground shaking and are subject to larger volumetric changes. Generally thicker deposits will accumulate more volumetric change than thinner deposits.

Liquefaction evaluations were beyond the scope of this study. However, saturated loose granular soils exist within, and below, sediments of the San Francisco Bay throughout the SBSP Restoration Project area. These soils are potentially liquefiable. The amount of liquefaction is expected to vary within a given pond complex based on density, depth, and thickness of potentially liquefiable soil layers. A liquefaction susceptibility map for the SBSP Restoration Project area (Knudsen and others, 2006) based on soil type, soil thickness and depth to groundwater is presented in Figure 2.

Generally, the thickness and consistency of loose saturated granular deposits within the SBSP Restoration Project area are expected to be discontinuous and may vary more abruptly along any given levee. Future subsidence from liquefaction of loose saturated granular soils may therefore vary more abruptly, potentially differentially, along any given levee. The amount of liquefaction may cause portions of existing outboard pond levees to settle to, or below, minimum elevations required to prevent overtopping. Differential settlements can be detrimental to corresponding infrastructure improvements like roads, railways, underground utilities, etc.

5.2.1.4 Subsidence From Consolidation of Deeper Santa Clara Valley Formation from Regional Groundwater Depletion

Moffatt & Nichols, 2005 reports that an additional foot of subsidence due to consolidation of deeper Santa Clara Valley formation from regional groundwater depletion can be expected over

a period of 30 years along portions of the inboard levees within the SBSP Restoration Project area.

5.2.2 Stability

5.2.2.1 Static Stability of Levee Slopes

Except for eroding levee faces, the existing salt pond levees are typically low to moderate in height and have fairly flat slopes. This configuration results in stable levees (M&N, 2005).

Periodic maintenance of the outboard pond levees that includes adding relatively small thicknesses of new fill (like that conducted by Cargill between 1995 through 2005) is not expected to have a significant impact on static stability of existing outboard pond levee slopes. Bay mud however is generally too weak to support large thicknesses of new fill placed at steep slopes in a single stage of construction.

5.2.2.2 Seismic Stability of Levee Slopes

When liquefaction occurs within an embankment at or near the surface of a slope (cut slope, fill slope, existing shoreline, existing river channel, etc.) strength loss within saturated granular soils during liquefaction may result in slope failure and lateral deformation (lateral spreading).

Liquefaction evaluations were beyond the scope of this study. However, saturated loose granular soils exist within, and below, sediments of the San Francisco Bay throughout the SBSP Restoration Project area. These soils are potentially liquefiable. During and immediately after ground shaking from a moderate to strong earthquake, saturated loose granular soils may lose strength, and may experience relatively rapid volumetric change. Liquefaction occurring near the surface of a levee slope may cause that slope to fail and deform.

It is possible to design and construct measures to reduce the risk of liquefaction and seismic slope failure. However, for the existing outboard pond levees, the cost of implementing such mitigation(s) likely is not cost feasible.

5.2.3 Erosion

The majority of the embankment slopes along existing outboard pond levees are vegetated. Some are protected with riprap. These slopes are subject to erosion caused by rain and wave action. The type and condition of levee slope protection per pond are summarized in Table 3 and illustrated on Figures 4r, 4e, and 4r.

From the Cargill maintenance records, we can infer a generalized rate and degree of levee erosion between 1995 and 2005 for each pond complex as indicated in the table below.

Cargill Maintenance Records 1995 - 2005			
	Ravenswood	Eden Landing	Alviso
Number of ponds	7	23	29
Total number of pond complex levee erosion maintenance	29	50	66
Total quantity of new fill placed per pond complex (CY/LF)	12,910 / 18,988	19,525 / 23,756	13,465 / 20,970
Average number of erosion events per pond	4	2	2
Average quantity of new fill placed per pond (CY/LF)	1,844 / 2,713	849 / 1,033	464 / 723
Maximum number of erosion events for individual pond (pond ID)	9 (R1)	11 (B2)	14 (A2W)
Maximum quantity of new fill placed for individual pond (CY/LF) (pond ID)	9,755 / 15,218 (R1)	6,745 / 7,010 (B2)	3,750 / 4,848 (A2W)

Notes:

1. Values in the table correspond to maintenance activities described in Cargill records as "erosion", "riprap", "slope repair". In some cases, quantity of fill placed is reported as volume (CY). In other cases, quantity of fill placed is reported as distance (LF). Not enough information is provided to convert LF to CY or to convert CY to LF. In some cases, a grading event is described, but no corresponding fill quantity is provided.
2. CY = cubic yards
3. LF = linear feet

Though appropriate for programmatic-level evaluations, the quantities presented in the Table above should be considered approximate. Limitations of the Cargill data are discussed in Section 3.1.3. In assessing need for future levee maintenance, it is important to point out that the Cargill data spans only a 10 year period.

Cargill erosion maintenance events per pond complex between 1995 and 2005 are also summarized in Table 1 and illustrated on Figures 6r, 6e, and 6r. Cargill erosion maintenance

events for each pond between 1995 and 2005 are summarized in Table 2 and illustrated on Figures 6r, 6e, and 6r. Individual Cargill maintenance events between 1995 and 2005 are summarized in Appendix D.

The degree and rate of future erosion will vary. From the Cargill maintenance records, we can develop generalized return rates for levee erosion maintenance activities between 1995 and 2005 for each pond complex as indicated in the table below.

Cargill Maintenance Records 1995 - 2005			
	Ravenswood	Eden Landing	Alviso
Number of ponds	7	23	29
Total number of erosion events per pond complex	29	50	66
Total return rate (years per event) of pond complex levee erosion maintenance	0.3	0.2	0.2
Average number of erosion events per pond	4	2	2
Average return rate (years per event) of pond levee erosion maintenance	3	5	5
Maximum number of grading events for individual pond (pond ID)	9 (R1)	11 (B2)	14 (A2W)
Minimum return rate (years per event) of levee erosion maintenance for individual pond (pond ID)	1.1 (R1)	0.9 (B2)	0.7 (A2W)

Notes:

1. Values in the table correspond to maintenance activities described in Cargill records as "erosion", "riprap", "slope repair". In some cases, quantity of fill placed is reported as volume (CY). In other cases, quantity of fill placed is reported as distance (LF). Not enough information is provided to convert LF to CY or to convert CY to LF. In some cases, a grading event is described, but no corresponding fill quantity is provided.
2. CY = cubic yards
3. LF = linear feet

These return rates can be extrapolated to estimate future erosion and/or maintenance requirements.

Though appropriate for programmatic-level evaluations, the quantities presented in the Table above should be considered approximate. Limitations of the Cargill data are discussed in

Section 3.1.3. In assessing need for future levee maintenance, it is important to point out that the Cargill data spans only a 10 year period. In assessing need for future levee maintenance, it is important to point out that the Cargill data spans only a 10 year period.

5.3 PROPOSED INBOARD FLOOD LEVEES

5.3.1 Evaluations Performed By Moffatt & Nichol, 2005

In 2005, Moffatt & Nichol prepared a report for the California State Coastal Conservancy to summarize evaluations performed for the then current configurations of new inboard flood control levees throughout the SBSP Restoration Project area, which could function as perimeter (Bayfront) levees after implementation of the proposed restoration project. The alignments of the new inboard flood control levees, evaluated by Moffat & Nichol, are similar to those currently being considered by the SBSP Restoration Project team.

Generally, new inboard levee configurations considered in Moffatt & Nichol 2005 included the following generalized sections of proposed conditions:

Location	Thickness of New Fill (feet)	Width of New Crest (feet)	Pondside Inclination of New Waterside Embankment Slope (Horiz:Vert)
Alviso - Charleston Slough & Pond A1	6.5	20	3:1 and 8:1
Alviso - Pond A1	5.5 to10.5	20	3:1 and 8:1
Alviso - Pond A2W	11 to16	20	3:1 and 8:1
Alviso - Pond A2E	12 to13	20	3:1 and 8:1
Alviso - Pond A3W	10	20	3:1 and 8:1
West Bay (Ravenswood) – Pond S	8 to11	20	3:1 and 8:1
West Bay (Ravenswood) – Pond 3	7 to 8	20	3:1 and 8:1

3:1 and 8:1 (horizontal:vertical) represent two separate cases for inclination of the new waterside slope. It appears that the landslide slope was assumed to be inclined at approximately 2:1 (horizontal:vertical). Moffatt & Nichol 2005 did not consider generalized sections of proposed conditions at Eden Landing.

5.3.2 Current Configurations of Proposed New Levees

Generally, new inboard levee configurations currently being considered include the following generalized sections of proposed conditions (PWA Draft Flood Assessment Report, 2006):

Location	Thickness of New Fill (feet)	Width of New Crest (feet)	Pondside Inclination of New Embankment Slope (Horiz:Vert)
Ravenswood – Alternative A	4.5 to 9.5	15	3:1 to 5:1
Ravenswood – Alternative B	4.5 to 7.5	15	3:1 to 30:1
Ravenswood – Alternative C	4.5 to 5.5	15	3:1
Eden Landing – Alternative A	1.5 to 6.5	15	3:1 to 5:1
Eden Landing – Alternative B	1.5 to 4.5	15	3:1 to 30:1
Eden Landing – Alternative C	1.5 to 3.5	15	3:1
Alviso – Alternative A	5.5 to 11.5	15	3:1 to 5:1
Alviso – Alternative B	5.5 to 9.5	15	3:1 to 30:1
Alviso – Alternative C	5.5 to 8.5	15	3:1

Locations of proposed inboard flood control levees are indicated in Figure 7. Alternative A represents "No Outboard Marsh" conditions, and includes an inboard "stability berm" (approximately 30 feet wide, plus 3H:1V slope), and an outboard "tidal bench" (approximately 30 feet wide, plus 5H:1V slope). Alternative B represents "With Outboard Marsh" conditions, and includes an inboard "stability berm" (approximately 30 feet wide, plus 3H:1V slope), and an outboard "upland transition area" (approximately 100 feet wide, plus 30H:1V slope). Alternative C represents "With Outboard Managed Pond" conditions, and includes an inboard "stability berm" (approximately 30 feet wide, plus 3H:1V slope), and an outboard "stability berm" (approximately 30 feet wide, plus 3H:1V slope).

5.3.3 Subsidence

5.3.3.1 General

In addition to the ongoing subsidence expected throughout the SBSP Restoration Project area, (discussed in section 5.2 above), construction of new inboard flood control levees will require adding significant thicknesses of new fill. The weight of the new fill will cause additional consolidation settlement of underlying soft Bay Mud. Consolidation of the Bay Mud from new fill is expected to occur over the course of years, in some cases decades. The degree and rate of additional subsidence caused by consolidation of Bay Mud within and below new inboard flood levee fills will vary depending on:

- the weight and density of recently added fill,
- the thickness and engineering characteristics of underlying Bay Mud, and
- schedule and sequence of new fill placement.

For longterm flood protection, design of new inboard levees will need to adequately account for the ongoing subsidence from previous fill placement activities (discussed in section 5.2 above) as well as for additional subsidence from new fill placement. During project-level design of new inboard flood protection levees, the team should consider the following three design approach alternatives:

- Design Approach Alternative 1 – Construct new inboard flood control levees in single stage to sufficient height without ground improvement that the new crests will not subside below required flood protection elevations throughout the levee's anticipated lifespan.

- Design Approach Alternative 2 – Construct new inboard flood control levees in single stage to sufficient height with ground improvement that the new crests will not subside below required flood protection elevations throughout the levee's anticipated lifespan.

- Design Approach Alternative 3 – Construct new inboard flood control levees in multiple stages. When levee crests subside below required flood protection elevations, raise and relevel them to extend the levee's anticipated lifespan.

Understanding which design approach best meets the owner's short term and long term project objectives, and costs will be important to help identify and focus future needs for supplemental geotechnical data and design. These design approach alternatives are discussed briefly below.

Design Approach Alternative 1 – Final crest elevations will incorporate:

- minimum required flood protection elevation (assume includes considerations for sea level rise, freeboard, wave run up, etc.),

- additional thickness for anticipated total long term ongoing subsidence of existing levee fill and underlying soft Bay Mud,

- additional thickness for anticipated total long term subsidence of new level fill and underlying soft Bay Mud.,

- additional thickness for anticipated total deformation (vertical and lateral) from liquefaction of loose saturated granular deposits during a large earthquake.

Alternative Advantages:

- design levee crest width can be the optimized minimum (future levee raising is not anticipated),

- single design effort,

- single construction effort,
- likely minimum overall project cost,
- frees the owner from logistical considerations for future levee access/reconstruction.

Alternative Disadvantages:

- design levee crest elevation will be the optimized maximum,
- for short term stability, levee embankment slopes will be flatter (broader), generally requiring more fill,
- initial design and construction costs will be higher.

Design Approach Alternative 2 – Final crest elevations will be based on the minimum required flood protection elevation (assume includes considerations for sea level rise, freeboard, wave run up, etc.). Subsidence from ongoing and new consolidation of soft Bay Mud, as well as from deformation (vertical and lateral) from liquefaction of loose saturated granular deposits during a large earthquake, will be mitigated through ground improvement.

Alternative Advantages:

- design levee crest width can be the optimized minimum,
- design levee crest elevation will be the optimized minimum,
- steepest levee embankment slopes are possible, generally limiting quantities of new fill,
- single design effort,
- improved resistance to deformation during/after large earthquake,
- single construction effort,
- frees the owner from logistical considerations for future levee access/reconstruction,

Alternative Disadvantages:

- ground improvement requires specialized design and construction,
- ground improvement is expensive and may not be cost feasible.

Design Approach Alternative 3 – Final crest elevations will incorporate:

- minimum required flood protection elevation (assume includes considerations for sea level rise, freeboard, wave run up, etc.),
- additional thickness for anticipated partial long term ongoing subsidence of existing levee fill and underlying soft Bay Mud,
- additional thickness for anticipated partial long term subsidence of new level fill and underlying soft Bay Mud,
- additional thickness for anticipated partial total deformation (vertical and lateral) from liquefaction of loose saturated granular deposits during a large earthquake.

Advantages:

- for short term stability, levee embankment slopes can be steeper, generally requiring less fill than in Alternative 1 (though not as steep as in Alternative 2),
- initial design and construction costs will be lower.

Alternative Disadvantages:

- design levee crest width will be larger to accommodate future levee crest raising(s),
- multiple design efforts,
- multiple construction efforts,
- overall design and construction costs will be higher,
- commits the owner to logistical considerations for future levee access/reconstruction.

Selection of a specific design approach will be based on the owner's short term and long term project objectives, and costs.

The geotechnical data included in this baseline levee model is of sufficient quantity and detail to perform regional, program level assessments. Subsequent project level levee design will require additional characterization (geotechnical investigation) and evaluation of site specific levee and subsurface conditions.

5.3.3.2 Alviso

The alignment of the new inboard flood control levees proposed within the Alviso pond complex are presented on Figure 7. Current contours of Bay Mud thickness (Figure 2) within the Alviso pond complex are fairly well defined. Figure 2 indicates new inboard flood control levees proposed within the Alviso pond complex will be constructed over as much as 15 feet of Bay Mud.

Evaluations from Moffatt & Nichol, 2005 indicate, for their inboard levee configurations, that up to 5 feet of subsidence may result from placement of up to 16 feet of new levee fill. This estimate does not include subsidence from potential liquefaction of loose saturated granular soils during an earthquake. The current inboard flood control levee configurations being considered by the SBSP Restoration project team for the Alviso pond complex (Alternatives A, B, and C, see Table above) generally involve placing less than 16 feet (about 6 to 12 feet) of new fill. These configurations then are generally expected to experience less subsidence from consolidation of Bay Mud under the weight of the new fill. The current inboard flood control levee configurations being considered by the SBSP Restoration project team for the Alviso pond complex (Alternatives A and C) generally involve constructing levees that have similar widths to those considered by Moffatt & Nichol, 2005. The current inboard flood control levee configuration being considered by the SBSP Restoration project team for the Alviso pond complex Alternative B generally involves constructing levees that are substantially wider than those considered by Moffatt & Nichol, 2005. The Alternative B levee configuration is generally expected to experience more subsidence than that of Alternatives A and C.

5.3.3.3 Ravenswood

The alignment of the new inboard flood control levees proposed within the Ravenswood pond complex are presented on Figure 7. Current contours of Bay Mud thickness (Figure 2) within the Ravenswood pond complex are not well defined. Figure 2 indicates new inboard flood control levees proposed within the Ravenswood pond complex will be constructed over as much as 15 feet of Bay Mud.

Evaluations from Moffatt & Nichol, 2005 indicate, for their inboard levee configurations that up to 4 feet of settlement may result from placement of up to 11 feet of new levee fill. This estimate does not include subsidence from liquefaction of loose saturated granular soils during an earthquake. The current inboard flood control levee configurations being considered by the SBSP Restoration project team for the Ravenswood pond complex (Alternatives A, B, and C) generally involve placing less than 11 feet (about 5 to 10 feet) of new fill. These configurations

then are generally expected to experience less subsidence from consolidation of Bay Mud under the weight of the new fill. The current inboard flood control levee configurations being considered by the SBSP Restoration project team for the Ravenswood pond complex (Alternatives A and C) generally involve constructing levees that have similar widths to those considered by Moffatt & Nichol, 2005. The current inboard flood control levee configuration being considered by the SBSP Restoration project team for the Ravenswood pond complex Alternative B generally involves constructing levees that are substantially wider than those considered by Moffatt & Nichol, 2005. The Alternative B levee configuration is generally expected to experience more subsidence than that of Alternatives A and C.

5.3.3.4 Eden Landing

The alignment of the new inboard flood control levees proposed within the Eden Landing pond complex are presented on Figure 7. Current contours of Bay Mud thickness (Figure 2) within the Eden Landing pond complex are not well defined. Figure 2 indicates new inboard flood control levees proposed within the Eden Landing pond complex will be constructed over as much as 10 feet of Bay Mud. Moffatt & Nichol, 2005 did not include settlement evaluations for proposed new inboard flood protection levees at Eden Landing.

5.3.4 Stability

5.3.4.1 Static Stability of Levee Slopes

Where new inboard flood protection levees are planned, raising existing levees to reach specified elevations to provide tidal flood protection will be required. Bay Mud, the prominent component of the existing inboard levees, is relatively weak, which may limit the height, or otherwise dictate the width, to which the new inboard flood protection levee improvements can be constructed. For design approach alternative 1 discussed in Section 5.3.3.1 above, the levees may need to be constructed with relatively flat embankment slopes. For design approach alternative 3 discussed in Section 5.3.3.1 above, the levees would be constructed in at least two stages. The time between construction stages (years, perhaps one decade) will allow the underlying clays to consolidate and gain strength. The levees would continue to settle after they are constructed to their designed crest elevations, and the levee crests would need to be designed with sufficient width to accommodate placing additional fill required to maintain the ultimate levee crest design elevation(s).

Static slope stability evaluations performed by Moffat & Nichol, 2005 indicate:

- levee embankment slopes of 8:1 (horizontal:vertical) are not stable to marginally stable for significant thicknesses of new fill constructed over a 15 foot layer of Bay Mud (strength ~ 200 psf),

- levee embankment slopes of 3:1 (horizontal:vertical) are marginally stable for significant thicknesses of new fill constructed over a 15 foot layer of Bay Mud (strength ~ 400 psf), and

- levee embankment slopes of 8:1 (horizontal:vertical) are generally stable for significant thicknesses of new fill constructed over a 15 foot layer of Bay Mud (strength ~ 400 psf).

5.3.4.2 Seismic Stability of Levee Slopes

Liquefaction evaluations were beyond the scope of this study. However, potentially liquefiable granular deposits exist throughout the SBSP Restoration Project area. The breadth and freeboard of the final levee configurations may be designed to accommodate expected vertical and lateral deformations due to liquefaction and lateral spreading. Alternatively ground improvement or modified levee alignments could be considered as possible mitigations.

Site specific geotechnical investigations and evaluations would be required to assess the occurrence and severity of liquefaction, as well as to support design of possible liquefaction mitigations.

5.3.5 Erosion

The outboard embankment slope along new inboard flood control levees will be subject to erosion caused by rain runoff and wave action. The inboard embankment slope along new inboard flood control levees will subject to erosion caused by rain runoff. The design of levee embankment slope protection will be an integral part of the flood control levee design(s).

6.0 LIMITATIONS

This report was prepared for the exclusive use of PWA Consultants, Inc. for the SBSP Restoration project, program-level assessment of existing levees. The findings presented in this report are based on the assumption that geologic conditions within the study area described herein and vicinity do not deviate appreciably from those depicted on available reports, maps, logs of explorations, historic photos, maintenance records, field notes, and observed during our reconnaissance. Future research or additional information may invalidate this report's findings. Additional work will be necessary to investigate and evaluate subsurface conditions in support of specific project-level levee design. Site-specific information may change the findings, and professional judgments presented in this report.

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TABLES

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TABLE 1
MAINTENANCE SUMMARY - POND COMPLEXES
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

Eden Landing

	Total Number of Events	Total Linear Feet	Total Cubic Yards
Subsidence Repair	283	139,165	5,730
Erosion Repair	50	23,756	19,525
All Repairs	333	162,921	25,255

Alviso

	Total Number of Events	Total Linear Feet	Total Cubic Yards
Subsidence Repair	397	413,179	3,780
Erosion Repair	66	20,970	13,465
All Repairs	463	434,149	17,245

Ravenswood

	Total Number of Events	Total Linear Feet	Total Cubic Yards
Subsidence Repair	103	116,723	1,780
Erosion Repair	29	18,988	12,910
All Repairs	132	129,333	21,068

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TABLE 2
MAINTENANCE SUMMARY - PONDS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

Pond	Unit	Discing	Dredge	Grading Events	Grading (lf)	Grading (cy)	Construction	Rip rap Events	Rip rap (lf)	Rip rap (cy)	Piles
A1	Alviso			20	10,900	0					
A10	Alviso	2		24	79,700	0		2	73	105	
A11	Alviso			19	29,600	450		4	213	273	
A12	Alviso	1		21	13,512	450		5	1,426	976	
A13	Alviso			25	25,010	0		7	1,947	1,174	
A14	Alviso			12	10,000	0					
A15	Alviso			26	6,947	1,020		8	2,640	675	
A16	Alviso	1		21	40,300	800		2	225	270	
A17	Alviso	2		17	20,700	0					
A19	Alviso			10	25,600	0					
A20	Alviso			8	0	0					
A21	Alviso			8	0	0					
A22	Alviso			17	14,380	100		6	4,200	750	
A23	Alviso	6		12	6,050	80					
A2E	Alviso	2		8	0	0					
A2W	Alviso	2		17	900	480		14	4,848	3,750	
A3N	Alviso	1		12	3,080	0		2	240	265	
A3W	Alviso			17	15,000	0		3	340	207	
A5	Alviso			15	26,800	100		2	1,040	350	
A6	Alviso			11	2,700	0		1	2,700	3,500	
A7	Alviso	5	1	14	16,900	200					
A8	Alviso			25	33,100	100					
A9	Alviso	1		16	20,000	0		2	73	105	
AB1	Alviso	6		13	12,000	0		8	1,005	1,065	
AB2	Alviso	5		9	0	0					
B1	Eden Landing	2		25	13,550	2,100	1	7	3,745	2,615	
B10	Eden Landing	1	2	14	1,300	1,035	2	9	2,197	2,515	
B11	Eden Landing			10	0	0					
B13	Eden Landing			10	750	0					

TABLE 2
MAINTENANCE SUMMARY - PONDS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

Pond	Unit	Discing	Dredge	Grading Events	Grading (lf)	Grading (cy)	Construction	Rip rap Events	Rip rap (lf)	Rip rap (cy)	Piles
B14	Eden Landing			11	0	2,000					
B1C	Eden Landing		4	31	18,240	160		2	2,475	1,165	
B2	Eden Landing	2	1	16	28,400	0		11	7,010	6,745	1
B2C	Eden Landing			16	0	70					
B4	Eden Landing			12	5,050	0					
B4C	Eden Landing			9	0	0					
B5	Eden Landing			12	5,250	0		5	200	250	
B5C	Eden Landing			16	22,400	0		4	3,825	3,160	
B6	Eden Landing			12	5,725	0					
B6A	Eden Landing			17	21,000	300		4	3,480	1,925	
B6B	Eden Landing			15	8,500	0					
B6C	Eden Landing			10	0	0					
B7	Eden Landing	1		13	5,800	55					
B8	Eden Landing			11	0	10		4	254	435	
B8A	Eden Landing			9	0	0	3				
B9	Eden Landing			14	3,200	0		4	570	715	
R1	Ravenswood	4		25	33,245	510		9	15,218	9,755	
R2	Ravenswood			15	0	3,970		3	2,320	1,360	
R3	Ravenswood			13	29,600	1,758					
R4	Ravenswood	5		16	20,800	300		8	550	715	
R5	Ravenswood	5		13	6,800	639					
S5	Ravenswood	5		10	12,100	981	2				
SF2	Ravenswood	1		11	7,800	0		9	900	1,080	

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Alviso	A1	E	Poor	Poor	Poor							ER	Slight	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A1	E										ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A1	E	Poor	Fair	Fair					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A1	E		Poor	Poor	CR						ER	Moderate	Poor	Vegetation	USACE 1988, 1989
Alvisio	A1	N	Good-Fair	Good-Fair								ER	Slight	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alvisio	A1	N										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A1	N	Fair	Fair	Fair					SL		ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A1	N	Fair	Fair-Poor	Fair-Poor	CR					UN			Fair	Vegetation	USACE 1988, 1989
Alviso	A1	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A1	S	Good	Good	Good											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A1	S	Good	Fair	Poor							ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A1	S	Good	Good	Fair									Good		M&N 2005
Alviso	A1	S										ER	Slight	Good	Vegetation	USACE 1988, 1989
Alviso	A1	W	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A1	W	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A1	W	Fair	Poor	Fair					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A1	W	Fair	Good	Fair									Good		M&N 2005
Alviso	A1	W														USACE 1988, 1989
Alviso	A10	E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A10	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A10	E	Poor	Poor	Poor				OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A10	NE-E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A10	NE-E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A10	S	Good-Fair	Good								ER	Moderate	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A10	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A10	S	Fair-Poor	Fair-Poor	Poor					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A10	W	Good-Fair	Good								ER	Moderate	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A10	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A10	W	Fair-Poor	Poor	Poor					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A11	E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A11	E	Fair-Poor	Fair-Poor	Fair-Poor						UN					GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A11	E	Poor	Poor	Poor	CR	SE		OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A11	S	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A11	S	Fair-Poor	Fair-Poor	Fair-Poor						UN					GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A11	S	Fair-Poor	Poor	Poor					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A11	W-N	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A11	W-N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A12	E	Good-Fair	Fair-Poor	Fair-Poor							ER	Slight	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A12	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A12	E	Fair	Fair-Poor	Fair-Poor	CR			OV	SL	UN	ER	Severe	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A12	E														M&N 2005
Alviso	A12	N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A12	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A12	N	Poor	Poor	Poor				OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A12	W	Fair-Poor	Fair-Poor	Fair-Poor						UN					GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A12	W	Fair-Poor	Fair-Poor	Poor					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A12	W-S	Good-Fair	Fair-Poor	Fair-Poor							ER	Slight	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Alviso	A12	W-S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A12	W-S	Fair-Poor	Fair-Poor	Poor					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A12	W-S														M&N 2005
Alviso	A13	E	Good-Fair	Good-Fair								ER	Slight			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A13	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A13	E	Fair	Fair-Poor	Fair-Poor	CR			OV			ER	Severe	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A13	N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A13	N														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A13	N	Fair-Poor	Poor	Poor					SL		ER	Severe	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A13	SW	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A13	SW	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A13	W	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A13	W	Fair-Poor	Fair-Poor	Fair-Poor						UN					GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A14	E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A14	E	Fair-Poor	Fair-Poor	Fair-Poor						UN					GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A14	E	Fair	Poor	Poor							ER	Moderate	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A14	N	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A14	N														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A14	N	Fair	Poor	Poor					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A14	N-E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A14	N-E														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A14	S	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A14	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A14	S	Poor	Poor	Poor				OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A14	W	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A14	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A14	W	Poor	Poor	Poor	CR				SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A15	E	Good-Fair	Good-Fair								ER	Slight			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A15	E										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A15	E	Fair-Poor	Fair-Poor	Fair-Poor					SL	UN	ER	Severe	Poor	Concrete	GMX 2006 (Field Reconnaissance)
Alviso	A15	N-E	Fair-Poor	Fair-Poor	Fair-Poor										None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A15	N-E														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A15	N-E	Fair	Fair-Poor	Fair					SL		ER	Moderate	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A15	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A15	S														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A15	S	Poor	Poor	Poor				OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A16	E	Fair-Poor	Good-Fair	Fair-Poor										None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A16	E														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A16	E	Fair	Fair	Fair-Poor					SL	UN	ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A16	E	Good	Good								ER	Slight	Good		M&N 2005
Alviso	A16	S	Fair-Poor	Good-Fair	Fair-Poor										None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A16	S														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A16	S	Fair	Fair	Fair					SL		ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A16	S	Good	Good								ER	Slight	Good		M&N 2005
Alviso	A16	W	Fair-Poor	Good-Fair	Fair-Poor										None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A16	W														GMX 2006 (1999 Aerial Photo Interpretation)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Alviso	A16	W	Fair	Fair-Poor	Fair-Poor						UN	ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A16	W	Good	Good								ER	Slight	Good		M&N 2005
Alviso	A17	E	Poor	Fair-Poor	Poor									Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A17	E														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A17	E	Fair-Poor	Fair	Fair-Poor						UN	ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A17	N	Poor	Fair-Poor	Poor									Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A17	N														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A17	N	Fair	Fair	Fair							ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A17	W	Poor	Fair-Poor	Poor									Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A17	W														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A17	W	Fair	Fair-Poor	Fair-Poor							ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A19	E	Poor	Fair-Poor								ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A19	NW	Poor	Fair-Poor										Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A19	S	Poor	Fair-Poor								ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A19	W	Poor	Fair-Poor										Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A20		Poor	Fair-Poor										Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A20															GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A21		Poor	Fair-Poor										Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A21															GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	E	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A22	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A22	E	Fair	Fair-Poor	Poor							ER	Intense	Fair-Poor	Vegetation	M&N 2005
Alviso	A22	E	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A22	N	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A22	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	N	Poor	Fair-Poor	Fair-Poor							ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A22	N	Fair	Fair-Poor	Poor							ER	Intense	Poor	Vegetation	M&N 2005
Alviso	A22	N	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A22	N-C	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A22	N-C	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	N-C	Fair-Poor	Fair-Poor	Poor							ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A22	N-C	Fair	Fair-Poor	Poor							ER	Intense	Poor	Vegetation	M&N 2005
Alviso	A22	N-C	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A22	N-W	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A22	N-W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	N-W	Poor	Fair-Poor	Poor							ER	Intense	Poor	Vegetation	M&N 2005
Alviso	A22	N-W	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A22	S-SE	Fair-Poor	Fair-Poor	Fair-Poor									Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A22	S-SE														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	S-SE	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A22	W-C	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A22	W-C	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	W-C	Fair-Poor	Fair-Poor	Poor							ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A22	W-C	Poor	Fair-Poor	Poor							ER	Intense	Poor	Vegetation	M&N 2005
Alviso	A22	W-C	Poor	Poor	Poor											USACE 1988, 1989

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Alviso	A22	W-N	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A22	W-N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	W-N	Fair-Poor	Poor	Poor				OV			ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A22	W-N	Poor	Fair-Poor	Poor							ER	Intense	Poor	Vegetation	M&N 2005
Alviso	A22	W-N	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A22	W-S	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A22	W-S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A22	W-S	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A22	W-S	Poor	Fair-Poor	Poor							ER	Intense	Poor	Vegetation	M&N 2005
Alviso	A22	W-S	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A23	E	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A23	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A23	E	Poor	Poor	Poor	CR						ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A23	E	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A23	N-NW	Fair-Poor	Fair-Poor	Fair-Poor									Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A23	N-NW														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A23	N-NW	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A23	S	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A23	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A23	S	Poor	Poor	Poor	CR						ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A23	S	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A23	W	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A23	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A23	W	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A23	W	Poor	Poor	Poor											USACE 1988, 1989
Alviso	A2E	E	Poor	Poor	Poor							ER	Severe	Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2E	E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2E	E	Fair	Good	Good							ER	Slight	Fair	Vegetation	USACE 1988, 1989
Alviso	A2E	N-NW	Poor	Poor	Poor					SL		ER	Intense			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2E	N-NW	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2E	N-NW	Poor	Poor	Poor	CR						ER	Intense	Poor	Vegetation	USACE 1988, 1989
Alviso	A2E	S-C	Fair-Poor	Fair-Poor	Fair-Poor									Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2E	S-C	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2E	S-C	Poor	Fair	Poor					SL		ER	Moderate	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A2E	S-C	Poor	Fair-Poor	Fair							ER	Intense	Fair-Poor	Vegetation	M&N 2005
Alviso	A2E	S-C	Poor	Poor	Poor	CR						ER	Intense	Poor	Vegetation	USACE 1988, 1989
Alviso	A2E	S-E	Fair-Poor	Fair-Poor	Fair-Poor									Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2E	S-E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2E	S-E	Poor	Fair-Poor	Poor					SL		ER	Intense	Fair-Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A2E	S-E	Poor	Fair-Poor	Fair							ER	Intense	Fair-Poor	Vegetation	M&N 2005
Alviso	A2E	S-E	Poor	Poor	Poor	CR						ER	Intense	Poor	Vegetation	USACE 1988, 1989
Alviso	A2E	S-W	Fair-Poor	Fair-Poor	Fair-Poor									Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2E	S-W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2E	S-W	Fair	Fair-Poor	Fair							ER	Slight	Fair	Concrete	GMX 2006 (Field Reconnaissance)
Alviso	A2E	S-W	Poor	Fair-Poor	Fair							ER	Intense	Fair-Poor	Vegetation	M&N 2005
Alviso	A2E	S-W	Poor	Poor	Poor	CR						ER	Intense	Poor	Vegetation	USACE 1988, 1989

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Alviso	A2E	W	Good	Fair-Poor	Good					SL		ER	Moderate	Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2E	W								SL						GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2E	W	Good-Fair	Fair	Fair					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A2E	W	Poor	Poor	Poor	CR						ER	Intense	Poor	Vegetation	USACE 1988, 1989
Alviso	A2W	E	Good	Fair-Poor	Fair-Poor							ER	Slight	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2W	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2W	E	Fair	Poor	Poor					SL		ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A2W	E	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Alviso	A2W	N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Intense	Good-Fair	Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2W	N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2W	N	Fair	Poor	Poor							ER	Moderate	Poor	Concrete	GMX 2006 (Field Reconnaissance)
Alviso	A2W	N	Poor	Fair	Fair	CR						ER	Moderate	Fair	Vegetation	USACE 1988, 1989
Alviso	A2W	N-E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Intense	Good-Fair	Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2W	N-E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2W	N-E	Fair	Poor	Poor							ER	Intense	Fair	Riprap	GMX 2006 (Field Reconnaissance)
Alviso	A2W	N-E	Poor	Fair	Fair	CR						ER	Moderate	Fair	Vegetation	USACE 1988, 1989
Alviso	A2W	N-W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Intense	Good-Fair	Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2W	N-W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2W	N-W	Fair	Poor	Poor							ER	Moderate	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A2W	N-W	Poor	Fair	Fair	CR						ER	Moderate	Fair	Vegetation	USACE 1988, 1989
Alviso	A2W	S	Good	Good	Good							ER	Slight			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2W	S	Good	Good	Good											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2W	S	Good							SL		ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A2W	S	Good	Fair-Poor	Fair							ER	Intense	Fair-Poor	Riprap	M&N 2005
Alviso	A2W	S	Good	Fair	Fair							ER	Slight	Good	Vegetation	USACE 1988, 1989
Alviso	A2W	W-N	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2W	W-N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2W	W-N	Poor	Fair-Poor	Poor					SL		ER	Intense	Poor	Riprap	GMX 2006 (Field Reconnaissance)
Alviso	A2W	W-N	Good	Fair	Fair							ER	Slight	Good	Vegetation	USACE 1988, 1989
Alviso	A2W	W-S	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A2W	W-S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A2W	W-S	Poor	Poor	Poor	CR			OV	SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A2W	W-S	Good	Fair	Fair							ER	Slight	Good	Vegetation	USACE 1988, 1989
Alviso	A3N	N	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A3N	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A3N	N	Fair-Poor	Fair	Fair					SL		ER	Intense	Poor	Concrete	GMX 2006 (Field Reconnaissance)
Alviso	A3N	S	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A3N	S														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A3N	S	Fair-Poor	Fair	Fair-Poor					SL		ER	Intense	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A3W	E	Good	Good	Good									Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A3W	E										ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A3W	E	Poor	Good	Good									Good	Riprap	M&N 2005
Alviso	A3W	N	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A3W	N	Fair-Poor	Fair-Poor	Fair-Poor					SL						GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A3W	N	Good-Fair	Fair	Fair							ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A3W	NW	Poor	Poor	Poor					SL		ER	Slight	Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
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			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Alviso	A3W	NW	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A3W	S	Good	Good	Good							ER	Slight	Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A3W	S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A3W	S	Good-Fair	Good-Fair	Good-Fair							ER	Slight	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A3W	S	Good	Poor	Fair							ER	Severe	Poor		M&N 2005
Alviso	A5	E	Good	Fair-Poor										Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A5	E										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A5	E	Poor	Poor	Poor	CR					UN	ER	Intense	Poor	Vegetation	USACE 1988, 1989
Alviso	A5	N	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A5	N														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A5	N	Good	Good								ER	Slight	Good	Vegetation	USACE 1988, 1989
Alviso	A5	NE	Poor	Poor	Poor				OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A5	NE	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A5	NE	Good	Good								ER	Slight	Good	Vegetation	USACE 1988, 1989
Alviso	A5	S-W-N	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A5	S-W-N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A5	S-W-N	Poor	Poor	Poor	CR					UN	ER	Intense	Poor	Vegetation	USACE 1988, 1989
Alviso	A6E	E	Poor	Poor	Poor			BR	OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6E	N	Poor	Poor	Poor			BR	OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6E	S	Poor	Poor	Poor			BR	OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6E	W	Poor	Poor	Poor			BR	OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6N	NE	Fair-Poor	Fair-Poor	Fair-Poor									Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6N	S	Poor	Poor	Poor			BR	OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6N	SW	Poor	Poor	Poor			BR	OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6W	E	Poor	Poor	Poor			BR	OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6W	NW	Fair-Poor	Fair-Poor	Fair-Poor									Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6W	S	Poor	Poor	Poor			BR	OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A6W	SW	Good	Good	Good									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A7	E	Good	Fair-Poor										Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A7	E														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A7	E										ER	Moderate			USACE 1988, 1989
Alviso	A7	N-NE	Poor	Fair-Poor								ER	Slight	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A7	N-NE														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A7	N-NE										ER	Moderate			USACE 1988, 1989
Alviso	A7	SW	Poor	Poor	Poor				OV			ER	Intense		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A7	SW														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A7	SW	Good	Good								ER	Slight	Good	Vegetation	USACE 1988, 1989
Alviso	A8N	NE	Fair-Poor	Fair-Poor	Fair-Poor									Good	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A8N	NE														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A8N	NE										ER	Moderate			USACE 1988, 1989
Alviso	A8N	S	Poor	Poor	Poor							ER	Severe		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A8N	S										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A8N	S	Good	Good								ER	Slight	Fair	Vegetation	USACE 1988, 1989
Alviso	A8N	W	Good	Fair-Poor										Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A8N	W										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A8N	W	Good	Good								ER	Slight	Fair	Vegetation	USACE 1988, 1989

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LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
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Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Alviso	A8Sn	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A8Sn	S														M&N 2005
Alviso	A8Sn	S	Fair	Fair	Fair	CR						ER	Slight	Fair	Vegetation	USACE 1988, 1989
Alviso	A8Sn	W-N-E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A8Sn	W-N-E	Good	Good								ER	Slight	Fair	Vegetation	USACE 1988, 1989
Alviso	A8Ss	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A8Ss	N	Fair	Fair	Fair	CR						ER	Slight	Fair	Vegetation	USACE 1988, 1989
Alviso	A8Ss	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A8Ss	S														M&N 2005
Alviso	A8Ss	S	Fair	Fair	Fair	CR						ER	Slight	Fair	Vegetation	USACE 1988, 1989
Alviso	A9	E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A9	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A9	N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A9	N										ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A9	N	Fair	Poor	Poor					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	A9	S	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Moderate		None	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A9	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A9	S	Poor	Poor	Poor				OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	A9	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate	Good-Fair	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	A9	W										ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	A9	W	Fair-Poor	Poor	Poor					SL		ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	AB1	N	Good-Fair	Fair-Poor	Fair-Poor							ER	Intense	Good-Fair	Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	AB1	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	AB1	N	Fair	Fair	Fair-Poor							ER	Intense	Fair-Poor	Concrete	GMX 2006 (Field Reconnaissance)
Alviso	AB1	N	Poor	Poor	Poor	CR						ER	Intense	Poor	Vegetation	USACE 1988, 1989
Alviso	AB1	S-E-SE	Poor	Poor	Poor					SL		ER	Intense			GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	AB1	S-E-SE	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	AB1	W	Good-Fair	Fair-Poor	Fair-Poor							ER	Intense	Good-Fair	Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	AB1	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	AB1	W	Good-Fair	Fair	Fair-Poor					SL		ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	AB1	W	Poor	Poor	Poor	CR						ER	Intense	Poor	Vegetation	USACE 1988, 1989
Alviso	AB2	E	Poor	Poor	Poor					SL		ER	Slight	Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	AB2	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	AB2	E	Fair	Fair	Poor							ER	Moderate	Fair-Poor	None	GMX 2006 (Field Reconnaissance)
Alviso	AB2	E	Fair	Good	Good							ER	Slight	Fair	Vegetation	USACE 1988, 1989
Alviso	AB2	N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Intense	Good-Fair	Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	AB2	N														GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	AB2	N	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Alviso	AB2	W	Poor	Poor	Poor							ER	Severe	Poor	Vegetation	GMX 2006 (1988 Aerial Photo Interpretation)
Alviso	AB2	W	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Alviso	AB2	W	Fair	Good	Good							ER	Slight	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B1	E	Poor	Poor	Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B1	E	Poor	Poor	Poor										Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B1	E	Poor	Fair-Poor	Fair					SL		ER	Severe	Poor	Concrete	GMX 2006 (Field Reconnaissance)
Eden Landing	B1	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B1	N														GMX 2006 (1999 Aerial Photo Interpretation)

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LEVEE CONDITIONS
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			Levee Condition:			Evidence of Distress:								Protection:		
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Eden Landing	B1	N	Fair	Fair	Fair					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B1	N	Fair	Fair								ER	Slight	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B1	S	Fair-Poor	Fair-Poor	Fair-Poor			BR			UN					GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B1	S	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B1	S	Poor	Poor	Poor			BR		SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B1	S	Fair	Fair								ER	Slight	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B1	W										ER	Slight			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B1	W														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B1	W	Poor	Poor	Poor		SE		OV			ER	Intense	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B10	E													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B10	E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B10	E	Poor	Fair	Poor									Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B10	E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B10	N										ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B10	N										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B10	N	Poor	Poor	Poor					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B10	N	Poor	Poor	Poor				OV					Poor		USACE 1988, 1989
Eden Landing	B10	N-E													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B10	N-E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B10	N-E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B10	N-W										ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B10	N-W										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B10	N-W	Poor							SL		ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B10	N-W	Poor	Poor	Poor				OV					Poor		USACE 1988, 1989
Eden Landing	B10	S	Fair-Poor	Fair-Poor	Fair-Poor					SL						GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B10	S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B10	S	Fair	Good-Fair	Fair									Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B10	S	Poor	Poor	Poor				OV			ER	Intense	Poor		USACE 1988, 1989
Eden Landing	B10	S-E	Fair-Poor	Fair-Poor	Fair-Poor					SL						GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B10	S-E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B10	S-E	Poor	Poor	Poor				OV			ER	Intense	Poor		USACE 1988, 1989
Eden Landing	B10	W													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B10	W	Fair-Poor	Fair-Poor	Fair-Poor					SL						GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B10	W	Poor	Fair	Fair					SL		ER	Moderate	Fair	Concrete	GMX 2006 (Field Reconnaissance)
Eden Landing	B10	W	Poor	Poor	Poor				OV					Poor		USACE 1988, 1989
Eden Landing	B11	E													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B11	E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B11	E	Poor	Fair	Fair					SL		ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B11	E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B11	N													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B11	N	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B11	N	Poor	Fair	Fair					SL		ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B11	N	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B11	S													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B11	S	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B11	S	Poor	Poor	Poor				OV	SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)

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Eden Landing	B11	S	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B11	S-E													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B11	S-E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B11	S-E	Good-Fair	Fair	Poor							ER	Moderate	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B11	S-E	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B11	W													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B11	W	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B11	W	Poor	Fair	Fair					SL		ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B11	W	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B12	N										ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B12	N										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B12	N	Fair-Poor	Poor	Fair							ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B12	N	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B12	S														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B12	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B12	W										ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B12	W										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B12	W	Good-Fair	Fair	Poor					SL		ER	Moderate	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B12	W	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B13	E										ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B13	E										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B13	E	Fair-Poor	Fair-Poor	Fair							ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B13	E	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B13	N-1	Good-Fair	Fair-Poor	Fair					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B13	N-2													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B13	N-2	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B13	N-2	Poor	Poor	Fair	CR			OV	SL		ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B13	N-2	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B13	S										ER			Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B13	S	Poor	Poor	Poor			BR								GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B13	S	Poor	Poor	Fair	CR		BR	OV	SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B13	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B13	W													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B13	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B13	W	Good-Fair	Fair	Fair					SL		ER	Moderate		Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B13	W	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B14	E-1	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B14	E-1	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B14	E-1	Poor	Fair-Poor	Fair				OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B14	E-1	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B14	E-2	Fair-Poor	Fair	Fair				OV	SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B14	N										ER			Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B14	N	Poor	Poor	Poor			BR								GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B14	N	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B14	S													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B14	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Eden Landing	B14	S	Poor	Poor	Poor	CR		BR	OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B14	S														USACE 1988, 1989
Eden Landing	B14	W													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B14	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B14	W	Fair	Fair	Fair					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B14	W														USACE 1988, 1989
Eden Landing	B1C	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B1C	E	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B1C	W														GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B1C	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B1C	W	Fair-Poor	Fair-Poor	Fair-Poor	CR						ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B1C	W	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B2	E	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight		Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2	E	Poor	Fair-Poor	Fair-Poor			BR						Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B2	E		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B2	NE	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2	NE													Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2	NE	Poor	Poor	Poor					SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B2	N-E	Fair-Poor	Fair-Poor	Fair-Poor			BR			UN					GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2	N-E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2	N-E	Poor	Poor	Poor					SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B2	N-E	Fair	Fair								ER	Slight	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B2	N-W	Fair-Poor	Fair-Poor	Fair-Poor			BR			UN					GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2	N-W														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2	N-W	Fair-Poor	Poor	Poor					SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B2	N-W	Poor	Poor	Poor		SE		OV			ER	Intense	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B2	S	Fair-Poor	Fair-Poor	Fair-Poor						UN	ER	Slight			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2	S	Poor	Fair-Poor	Fair-Poor					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B2	S		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B2	W-N	Fair-Poor	Fair-Poor	Fair-Poor			BR			UN					GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2	W-N														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2	W-N	Poor	Poor	Poor	CR				SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B2	W-N	Poor	Poor	Poor		SE		OV			ER	Intense	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B2	W-S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2	W-S	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2	W-S	Fair-Poor	Poor	Poor					SL	UN	ER	Intense	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B2	W-S	Poor	Poor	Poor	CR						ER	Intense	Poor	Vegetation	USACE 1988, 1989
Eden Landing	B2C	E	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2C	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2C	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B2C	E	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B2C	N								SL		ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2C	N														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2C	N	Fair	Fair-Poor	Fair-Poor					SL		ER	Moderate	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Eden Landing	B2C	N	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B2C	S								SL		ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B2C	S														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B2C	S	Good	Good-Fair	Good-Fair							ER	Moderate	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B2C	S	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B4	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B4	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B4	E	Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B4	E		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B4	N	Poor	Poor	Poor							ER			Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B4	N	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B4	N		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B4	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B4	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B4	S	Poor	Fair-Poor	Fair-Poor							ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B4	S		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B4	W	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B4	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight		Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B4	W	Poor	Fair-Poor	Fair-Poor			BR						Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B4	W		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B4C	NW-N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B4C	NW-N	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B4C	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B4C	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B4C	S	Fair	Fair-Poor	Fair-Poor					SL		ER	Moderate	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B4C	SW	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B4C	SW	Poor	Poor	Poor			BR								GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B5	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5	E	Good-Fair	Good-Fair	Good-Fair							ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B5	E	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B5	NW-W	Poor	Poor	Poor							ER			Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B5	NW-W	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5	NW-W	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B5	SE-E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B5	SE-E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5	SE-E	Fair	Fair-Poor	Fair-Poor	CR				SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B5	SE-E	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B5	SE-W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B5	SE-W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5	SE-W	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B5C	N	Fair-Poor	Fair-Poor	Fair-Poor			BR								GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B5C	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5C	NE	Poor	Poor	Poor			BR				ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B5C	NE	Poor	Poor	Poor			BR								GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5C	S	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)

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LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
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Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Eden Landing	B5C	S	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5C	S	Fair	Fair-Poor	Fair-Poor					SL		ER	Moderate	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B5C	S	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B5C	SE	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B5C	SE	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5C	SE	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B5C	SW-NW	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B5C	SW-NW	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B6	E	Fair-Poor	Fair-Poor	Fair-Poor						UN	ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6	E	Good-Fair	Good-Fair	Good-Fair							ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6	E	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B6	N	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6	N	Fair	Poor	Fair							ER	Intense	Fair	Concrete	GMX 2006 (Field Reconnaissance)
Eden Landing	B6	N	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B6	S	Poor	Poor	Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6	S	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6	S	Poor	Poor	Poor					SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B6	S	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B6	W	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6	W	Fair	Fair	Fair					SL		ER		Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6	W	Good	Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B6A	E	Fair-Poor	Fair-Poor	Fair-Poor						UN	ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6A	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6A	E	Fair	Fair	Fair							ER	Intense	Fair	Concrete	GMX 2006 (Field Reconnaissance)
Eden Landing	B6A	E	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B6A	N	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6A	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6A	N	Fair	Fair	Fair					SL		ER	Moderate	Fair	Riprap	GMX 2006 (Field Reconnaissance)
Eden Landing	B6A	S	Fair-Poor	Fair-Poor	Fair-Poor						UN	ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6A	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6A	S	Fair-Poor	Fair	Fair							ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6A	S	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B6A	W-NW	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6A	W-NW										ER	Moderate		Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6A	W-NW	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B6B	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6B	E										ER	Moderate		Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6B	E	Poor	Poor	Poor				OV	SL		ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6B	N	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6B	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6B	N	Fair-Poor	Fair	Fair							ER	Moderate	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6B	N	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B6B	W										ER				GMX 2006 (1988 Aerial Photo Interpretation)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Eden Landing	B6B	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6B	W	Fair-Poor	Poor	Poor					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6B	W	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B6B	W-SW										ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6B	W-SW	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6B	W-SW	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B6C	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6C	E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6C	E	Fair-Poor	Fair-Poor	Fair-Poor				OV	SL		ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6C	E		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B6C	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6C	N														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6C	N	Fair-Poor	Fair-Poor	Fair-Poor	CR						ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6C	N		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B6C	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6C	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6C	S	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6C	S		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B6C	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B6C	W	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B6C	W	Fair-Poor	Fair-Poor	Fair-Poor				OV			ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B6C	W		Good	Good									Good	Vegetation	USACE 1988, 1989
Eden Landing	B7	E	Poor	Poor	Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B7	E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B7	E	Poor	Poor	Poor			BR		SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B7	N	Fair-Poor	Fair-Poor	Fair-Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B7	N														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B7	N	Fair	Fair	Fair					SL		ER	Intense	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B7	NW-SW	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B7	NW-SW													Riprap	GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B7	SE-S	Poor	Poor	Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B7	SE-S	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8	E									UN	ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8	E	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B8	N	Poor	Poor	Poor			BR				ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8	N	Fair-Poor	Fair	Poor					SL		ER	Intense	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B8	N	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B8	NE													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8	NE	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8	NE	Fair	Poor	Poor				OV	SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B8	S									UN	ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8	S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8	S	Fair-Poor	Poor	Fair					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B8	S	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B8	W													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Eden Landing	B8	W	Fair-Poor	Fair-Poor	Fair-Poor					SL						GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8	W	Fair-Poor	Fair	Fair	CR				SL		ER	Intense	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B8	W	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B8A	E													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8A	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8A	E	Fair-Poor	Poor	Poor					SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	B8A	E	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B8A	N													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8A	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8A	N	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B8A	S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8A	S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8A	S	Fair	Poor	Poor					SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B8A	S	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	B8A	W													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8A	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8A	W	Fair-Poor	Fair	Fair					SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B8A	W	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B8N	E										ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8N	E										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8N	E	Fair	Poor	Poor					SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B8N	E	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B8N	N	Poor	Poor	Poor							ER				GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8N	N	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8N	N	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B8N	S										ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8N	S										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8N	S	Fair-Poor	Poor	Fair					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B8N	S	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B8N	W													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B8N	W	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B8N	W	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B9	E													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B9	E	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B9	E	Poor	Poor	Fair				OV	SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B9	E	Fair	Poor	Poor				OV			ER	Intense	Fair-Poor	Vegetation	USACE 1988, 1989
Eden Landing	B9	N													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B9	N														GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B9	N	Fair	Fair	Fair					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B9	N														USACE 1988, 1989
Eden Landing	B9	N-E													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B9	N-E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B9	N-E														USACE 1988, 1989
Eden Landing	B9	S													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B9	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B9	S	Fair	Poor	Fair					SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Eden Landing	B9	S														USACE 1988, 1989
Eden Landing	B9	W													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	B9	W	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	B9	W	Fair-Poor	Fair	Fair					SL		ER	Intense	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	B9	W														USACE 1988, 1989
Eden Landing	BT1	E													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	BT1	E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	BT1	E	Poor	Poor	Poor				OV			ER	Intense	Poor		USACE 1988, 1989
Eden Landing	BT1	N													Riprap	GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	BT1	N	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	BT1	N	Poor	Poor	Poor	CR	SE	BR	OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	BT1	N	Poor	Poor	Poor				OV			ER	Intense	Poor		USACE 1988, 1989
Eden Landing	BT1	S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	BT1	S	Fair-Poor	Fair-Poor	Fair-Poor					SL						GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	BT1	S	Poor	Poor	Poor					SL	UN	ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	BT1	S	Fair	Fair	Fair				OV			ER	Intense	Fair	Vegetation	USACE 1988, 1989
Eden Landing	BT1	W	Poor	Poor	Poor											GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	BT1	W	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	BT1	W	Poor	Poor	Poor	CR	SE	BR	OV	SL	UN	ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Eden Landing	BT1	W	Poor	Poor	Poor				OV			ER	Intense	Poor	Vegetation	USACE 1988, 1989
Eden Landing	BT2	E										ER	Slight			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	BT2	E	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	BT2	E	Poor	Poor	Poor					SL		ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	BT2	E	Poor	Poor	Poor		SE		OV			ER	Intense	Poor	Vegetation	USACE 1988, 1989
Eden Landing	BT2	N										ER	Moderate			GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	BT2	N	Fair-Poor	Fair-Poor	Fair-Poor						UN	ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Eden Landing	BT2	N	Poor	Fair	Fair					SL		ER	Severe	Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Eden Landing	BT2	SW	Poor	Poor	Poor			BR								GMX 2006 (1988 Aerial Photo Interpretation)
Eden Landing	BT2	SW														GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	E													Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	E														GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	E	Good-Fair	Good	Good							ER	Slight	Good	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R1	E	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R1	N													Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	N	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	N	Poor	Fair	Fair-Poor	CR			OV	SL		ER	Intense	Fair-Poor	Concrete	GMX 2006 (Field Reconnaissance)
Ravenswood	R1	NE													Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	NE	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	NE	Good-Fair	Fair-Poor	Fair					SL		ER	Moderate	Good-Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R1	NE	Fair-Poor	Fair	Good					SL		ER	Moderate	Good-Fair	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R1	N-E													Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	N-E	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	N-W													Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	N-W	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	N-W	Fair	Poor	Poor							ER	Intense	Fair-Poor	Concrete	GMX 2006 (Field Reconnaissance)
Ravenswood	R1	Out-E	Poor	Poor	Poor							ER	Severe	Poor	Concrete	GMX 2006 (Field Reconnaissance)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Ravenswood	R1	S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	S	Fair	Fair	Fair							ER	Slight	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R1	S	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R1	S-W										ER	Moderate		Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	S-W										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	S-W	Fair	Fair	Fair							ER	Moderate	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R1	S-W	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R1	W-N													Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	W-N	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	W-N	Fair	Good-Fair	Good-Fair							ER	Slight	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R1	W-S													Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R1	W-S	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R1	W-S	Fair	Fair-Poor	Fair							ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R2	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R2	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R2	N	Poor	Poor	Fair	CR			OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Ravenswood	R2	N	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R2	N-W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R2	N-W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R2	N-W	Poor	Poor	Fair	CR			OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Ravenswood	R2	N-W	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R2	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R2	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R2	S	Fair-Poor	Fair-Poor	Fair-Poor					SL		ER	Moderate	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R2	S	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R2	S-E	Poor	Poor	Poor			BR	OV			ER	Moderate			GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R2	S-E	Poor	Poor	Poor			BR	OV			ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R2	S-E	Fair	Poor	Poor					SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R2	S-E	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R2	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R2	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R2	W	Poor	Poor	Fair				OV	SL		ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Ravenswood	R2	W	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R3	E-N-N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R3	E-N-N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R3	E-N-N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R3	E-N-N	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R3	E-N-S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R3	E-N-S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R3	E-N-S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R3	E-N-S	Good	Fair-Poor	Good							ER	Intense	Fair-Poor	Vegetation	M&N 2005
Ravenswood	R3	E-N-S	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R3	E-S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R3	E-S	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R3	E-S	Fair	Fair-Poor	Poor	CR						ER	Severe	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
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			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Ravenswood	R3	E-S	Good	Fair-Poor	Good							ER	Intense	Fair-Poor	Vegetation	M&N 2005
Ravenswood	R3	E-S	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R3	N-E	Poor	Fair-Poor	Fair-Poor	CR			OV			ER	Severe	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R3	NW										ER	Slight		Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R3	NW										ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R3	NW	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R3	S-E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R3	S-E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R3	S-E	Fair-Poor	Fair-Poor	Poor					SL		ER	Severe	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R3	S-E	Good	Fair-Poor	Good							ER	Intense	Fair-Poor	Vegetation	M&N 2005
Ravenswood	R3	S-E	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R3	S-W										ER	Slight			GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R3	S-W										ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R3	S-W	Fair-Poor	Fair-Poor	Fair-Poor	CR						ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R3	S-W	Good	Poor	Fair							ER	Severe	Poor		M&N 2005
Ravenswood	R3	S-W	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989
Ravenswood	R3	W													Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R3	W	Fair-Poor	Fair-Poor	Fair-Poor				OV							GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R3	W	Fair-Poor	Poor	Poor				OV			ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Ravenswood	R3	W	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R4	N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R4	N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R4	N	Fair	Poor	Poor							ER	Severe	Poor	Concrete	GMX 2006 (Field Reconnaissance)
Ravenswood	R4	N	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R4	N-E										ER	Moderate			GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R4	N-E										ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R4	N-E	Fair-Poor	Poor	Poor					SL		ER	Severe	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	R4	N-E	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R4	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R4	S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R4	S	Poor	Fair-Poor	Poor	CR						ER	Moderate	Poor	None	GMX 2006 (Field Reconnaissance)
Ravenswood	R4	S	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R4	S-E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R4	S-E	Fair-Poor	Fair-Poor	Fair-Poor							ER	Slight			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R4	S-E	Poor	Good-Fair	Poor	CR						ER	Severe	Poor	None	GMX 2006 (Field Reconnaissance)
Ravenswood	R4	S-E	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R4	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R4	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R4	W	Fair	Poor	Poor							ER	Slight	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R5	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R5	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R5	E	Fair	Poor	Poor							ER	Slight	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R5	N														GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	R5	N	Fair	Poor	Poor							ER	Slight	Poor	Vegetation	USACE 1988, 1989
Ravenswood	R5	SW	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	R5	SW	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)

TABLE 3
LEVEE CONDITIONS
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, CA

			Levee Condition:			Evidence of Distress:								Protection:		
Complex	Pond ID	Orientation	Crest	Slope	Toe	Cracking	Seepage	Breach	Overtopping	Slumping	Undercutting/ Gullying	Erosion	Erosion Intensity	Protection Condition	Protection Type	Source
Ravenswood	R5	SW	Fair	Poor	Poor							ER	Slight	Poor	Vegetation	USACE 1988, 1989
Ravenswood	RT1	E	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	RT1	E	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989
Ravenswood	RT1	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	RT1	N	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	RT1	N	Fair	Poor	Poor							ER	Slight	Poor	Vegetation	USACE 1988, 1989
Ravenswood	RT1	S	Poor	Poor	Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	RT1	S	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	RT1	S	Poor	Poor	Poor							ER	Moderate	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	RT1	S	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989
Ravenswood	RT2															GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	RT2		Fair	Poor	Poor							ER	Slight	Poor	Vegetation	USACE 1988, 1989
Ravenswood	S5	NE	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	S5	NE	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	S5	NE	Good	Fair-Poor	Fair							ER	Intense	Fair-Poor		M&N 2005
Ravenswood	S5	NE	Poor	Poor	Poor							ER	Intense	Poor	Vegetation	USACE 1988, 1989
Ravenswood	S5	S	Poor	Poor	Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	S5	S	Poor	Poor	Poor							ER	Moderate	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	S5	S	Good	Fair	Good							ER	Moderate	Fair		M&N 2005
Ravenswood	S5	S	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989
Ravenswood	S5	W	Fair-Poor	Fair-Poor	Fair-Poor											GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	S5	W	Fair	Poor	Poor								Slight	Poor	Vegetation	USACE 1988, 1989
Ravenswood	SF2	E	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	SF2	E	Poor	Poor	Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	SF2	E	Poor	Good-Fair	Fair							ER	Slight	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	SF2	E	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989
Ravenswood	SF2	N-W														GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	SF2	N-W	Poor									ER	Slight	Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	SF2	S-E-C	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	SF2	S-E-C	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	SF2	S-E-C	Good	Good	Good									Good	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	SF2	S-E-C	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989
Ravenswood	SF2	S-E-N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	SF2	S-E-N	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	SF2	S-E-N	Good	Good-Fair	Good							ER	Slight	Good	Riprap	GMX 2006 (Field Reconnaissance)
Ravenswood	SF2	S-E-N	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989
Ravenswood	SF2	S-E-S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate		Riprap	GMX 2006 (1989 Aerial Photo Interpretation)
Ravenswood	SF2	S-E-S	Fair-Poor	Fair-Poor	Fair-Poor							ER	Moderate			GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	SF2	S-E-S	Poor	Good-Fair	Fair							ER	Moderate	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	SF2	S-E-S	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989
Ravenswood	SF2	S-W														GMX 2006 (1999 Aerial Photo Interpretation)
Ravenswood	SF2	S-W	Fair-Poor	Fair-Poor	Fair-Poor	CR				SL		ER	Intense	Fair-Poor	Vegetation	GMX 2006 (Field Reconnaissance)
Ravenswood	SF2	S-W	Good	Fair	Fair									Fair	Vegetation	USACE 1988, 1989

FIGURES

Eden Landing

Ravenswood

Alviso

SITE

California

Explanation

- Project area
- Deep Bay
- Fully Tidal Bayland
- Shallow Bay
- Active Salt Pond
- Beach
- Diked Marsh
- Farmed Bayland or Grazed Bayland
- Tidal Marsh or Managed Marsh
- Inactive Salt Pond
- Lagoon
- Major Channel
- Ruderal
- Storage or Treatment Basin

N

0 1 2 Miles

SITE LOCATION MAP
Levee Assessment
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, California

By: TM	Date:10/25/06	Project No. 9378.002
Geomatrix		Figure 1

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Explanation

Project boundary

20 Bay mud isopach (in feet)

Project pond

Deep Bay

Fully Tidal Bayland

Shallow Bay

Liquefaction Susceptibility

Very High

High

Moderate

Low

Very Low

N

0 1 2 Miles

BAY MUD THICKNESS AND BORINGS
Levee Assessment
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, California

By: SB	Date:10/25/06	Project No. 9378.002
Geomatrix		Figure 2

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Explanation

A22 Project pond

Levee Conditions

- Good
- Good to Fair
- Fair
- Fair to Poor
- Poor

Key to Location

- Crest of Levee
- Slope of Levee
- Toe of Levee

N

0 4,000 8,000 Feet

LEVEE ALIGNMENT CONDITION
ALVISO
Levee Assessment
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, California

By: SB	Date:10/25/06	Project No. 9378.002
Geomatrix	Figure	3a

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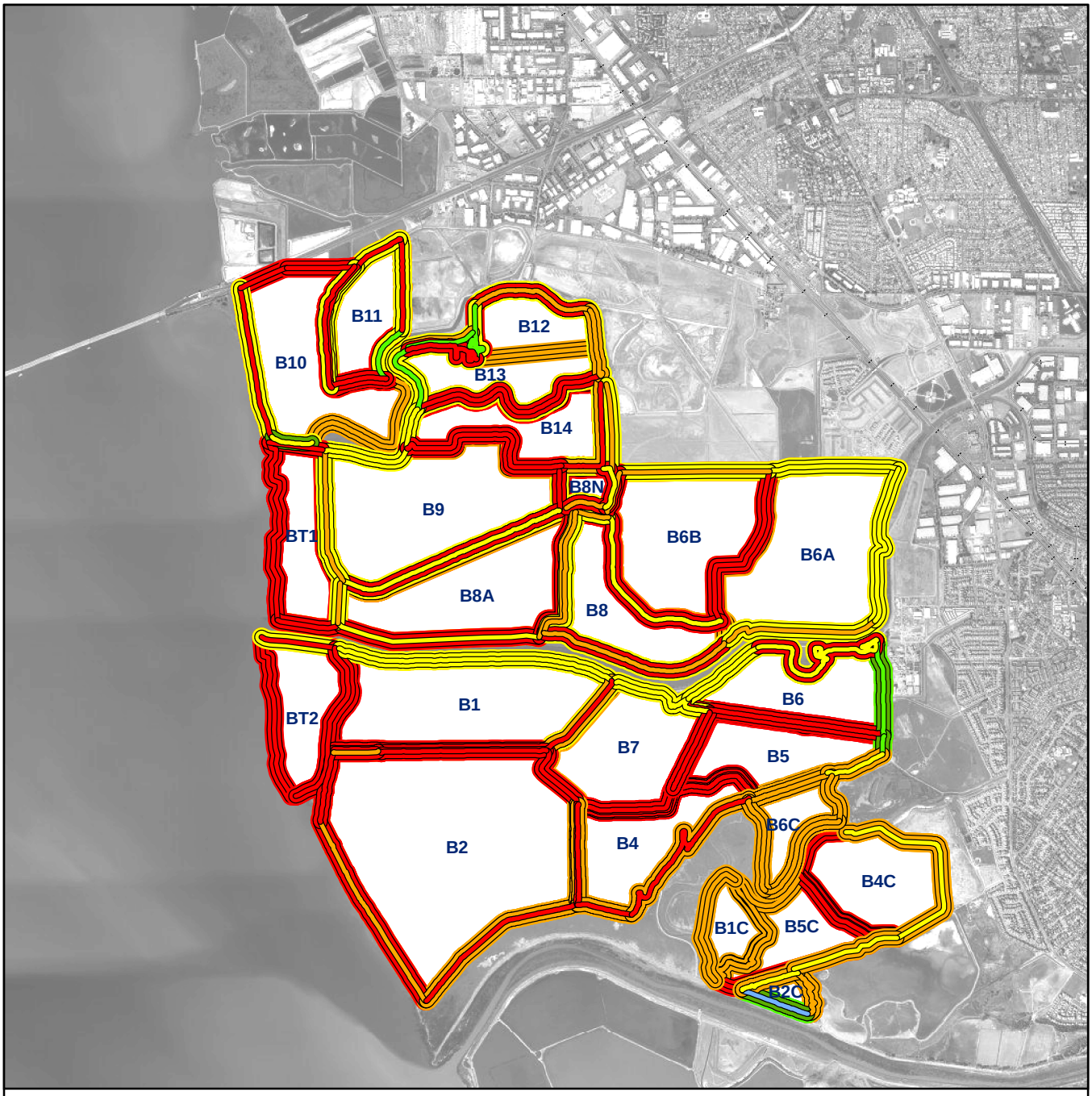

Explanation

B7 Project pond

Levee Conditions

- Good
- Good to Fair
- Fair
- Fair to Poor
- Poor

Key to Location

- Crest of Levee
- Slope of Levee
- Toe of Levee

N

0 4,000 8,000 Feet

LEVEE ALIGNMENT CONDITION
EDEN LANDING
Levee Assessment
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, California

By: SB	Date:10/25/06	Project No. 9378.002
Geomatrix		Figure 3e

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Explanation

R1 Project pond

Levee Conditions

- Good
- Good to Fair
- Fair
- Fair to Poor
- Poor

Key to Location

- Crest of Levee
- Slope of Levee
- Toe of Levee

N

0 4,000 8,000 Feet

LEVEE ALIGNMENT CONDITION
RAVENSWOOD
Levee Assessment
South Bay Salt Ponds Restoration Project
San Francisco Bay Area, California

By: SB	Date:10/25/06	Project No. 9378.002
Geomatrix		Figure 3r

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